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CLAIMS

1. A sensor device comprising:

a multiplicity of sensor elements arranged at a front surface of a substrate, each of said sensor elements being in contact with material of said substrate; and

a multiplicity of barriers arranged in said material of said substrate to reduce the coupling of a form of energy between any of said sensor elements, each barrier posing an obstacle to the propagation of said form of energy impinging thereon.

2. The device as recited in claim 1, wherein said barriers are located in areas between neighboring sensor elements.

3. The device as recited in claim 1, wherein said sensor elements are arranged in a row with spacing between neighboring sensor elements, and said barriers are interleaved with said sensor elements, each pair of neighboring sensor elements having a respective barrier therebetween.

4. The device as recited in claim 1, wherein said sensor elements are arranged in a two-dimensional array with spacing between neighboring sensor elements, and said barriers form an interconnected network that defines a multiplicity of bounded areas, each bounded area being occupied by a respective sensor element.

5. The device as recited in claim 1, wherein each of said sensor elements comprises a respective multiplicity of ULTRASONIC TRANSDUCER cells electrically connected together.

6. The device as recited in claim 1, wherein each of said barriers comprises a respective trench.

7. The device as recited in claim 6, wherein each of said trenches starts at said front surface of said substrate and has a depth less than a thickness of said substrate.

8. The device as recited in claim 6, wherein each of said trenches starts at a rear surface of said substrate and has a depth less than a thickness of said substrate.

9. The device as recited in claim 6, wherein each of said sensor elements comprises a respective ultrasonic transducer element, and said trenches are filled with acoustically attenuative material.

10. The device as recited in claim 6, wherein each of said sensor elements comprises a respective ultrasonic transducer element, further comprising a body of acoustically attenuative material that supports said substrate.

11. The device as recited in claim 6, wherein said trenches and adjoining portions of said substrate are coated with a thin layer of insulating material.

12. The device as recited in claim 6, wherein a surface of each of said trenches is coated with an electrically conductive material that is grounded to electrically isolate one sensor element from the next.

13. The device as recited in claim 1, wherein each of said barriers comprises a respective volume of said material of said substrate that has doping agents implanted therein, said doped material having the ability to substantially prevent the flow of electric current therethrough.

14. The device as recited in claim 13, wherein each of said implanted volumes comprises a conductive region that is grounded to prevent charge transfer from one element to the next.

15. The device as recited in claim 13, wherein each of said implanted volumes comprises a respective semiconductive junction.

16. The device as recited in claim 13, wherein each of said volumes comprises a respective pair of back-to-back pn junction diodes.

17. The device as recited in claim 13, wherein each of said implanted volumes comprises a respective near-insulating region.

18. A method of manufacturing a sensor device comprising the following steps:

micromachining an array of sensor elements in or on a substrate; and

forming a multiplicity of barriers in said material of said substrate to reduce the coupling of a form of energy between any of said sensor elements, each barrier posing an obstacle to the propagation of said form of energy impinging thereon.

19. The method as recited in claim 18, wherein said barriers are located in areas between neighboring sensor elements.

20. The method as recited in claim 18, wherein said sensor elements are arranged in a row with spacing between neighboring sensor elements, and said barriers are interleaved with said sensor elements, each pair of neighboring sensor elements having a respective barrier therebetween.

21. The method as recited in claim 18, wherein said sensor elements are arranged in a two-dimensional array with spacing between neighboring sensor elements, and said barriers form an interconnected network that defines a multiplicity of bounded areas, each bounded area being occupied by a respective sensor element.

22. The method as recited in claim 18, wherein said barriers are trenches.

23. The method as recited in claim 22, further comprising the step of filling said trenches with acoustically attenuative material.

24. The method as recited in claim 22, wherein said trenches are formed by dicing, laser cutting or etching.

25. The method as recited in claim 22, wherein each of said sensor elements comprises a respective ultrasonic transducer element, further comprising the step of attaching a body of acoustically attenuative material to a rear face of said substrate.

26. The method as recited in claim 25, wherein said trenches are formed by dicing completely through the thickness of said substrate and into said body of acoustically attenuative material.

27. The method as recited in claim 22, further comprising the step of coating said trenches and adjoining portions of said substrate with a thin layer of electrically insulating material.

28. The method as recited in claim 22, further comprising the steps of coating at least a portion of each trench with an electrically conductive material and then connecting said electrically conductive material to ground in order to electrically isolate one sensor element from the next.

29. The method as recited in claim 18, wherein said forming step comprises implanting doping agents in respective volumes of said material of said substrate, said doped material having the ability to substantially prevent the flow of electric current therethrough.

30. The method as recited in claim 18, wherein said forming step comprises implanting doping agents in respective volumes of said material of said substrate, said doped material having the ability to substantially transfer

charge to ground, preventing the flow of electric current from one sensor element to the next.

31. The method as recited in claim 29, wherein said doping agents are implanted in a pattern that forms a respective semiconductive junction for each barrier.

32. The method as recited in claim 29, wherein said doping agents are implanted in a pattern that forms a respective pair of back-to-back pn junction diodes for each barrier.

33. The method as recited in claim 29, wherein said doping agents are implanted in a pattern that forms a respective near-insulating region for each barrier.

34. The method as recited in claim 18, wherein said micromachining step comprises micromachining a multiplicity of ultrasonic transducer cells in or on said substrate, further comprising the step of electrically connecting said ultrasonic transducer cells into groups that form respective sensor elements.

35. An ultrasonic transducer device comprising:

a multiplicity of ultrasonic transducer elements arranged at a front surface of a substrate, each of said transducer elements comprising a respective group of ultrasonic transducer cells electrically connected together and acoustically coupled to said substrate; and

a multiplicity of trenches in said material of said substrate, said trenches being disposed in areas between said transducer elements, and said trenches obstructing the propagation of acoustic wave energy therethrough.

36. The device as recited in claim 35, wherein said trenches are filled with acoustically attenuative material.

37. The device as recited in claim 35, further comprising a body of acoustically attenuative material acoustically coupled to a rear face of said substrate.

38. The device as recited in claim 35, wherein said trenches and adjoining portions of said substrate are coated with a thin layer of insulating material.

39. The device as recited in claim 35, wherein a surface of each of said trenches is coated with an electrically conductive material that is grounded to electrically isolate one transducer element from the next.

40. A sensor device comprising:

a multiplicity of sensor elements arranged at a front surface of a substrate, each of said sensor elements being in contact with material of said substrate; and

a multiplicity of zones of dopant implantation in said material of said substrate, said zones being disposed in areas between said sensor elements, and said zones obstructing the flow of electric current therethrough.

41. The device as recited in claim 40, wherein each of said zones is doped to transfer charge to ground, preventing the flow of electric current from one sensor element to the next.

42. The device as recited in claim 40, wherein each of said zones comprises a respective semiconductive junction.

43. The device as recited in claim 40, wherein each of said zones comprises a respective pair of back-to-back pn junction diodes.

44. The device as recited in claim 40, wherein each of said zones comprises a respective near-insulating region.

45. A method of manufacturing a sensor device comprising the following steps:

micromachining an array of sensors on one side of a substrate;

attaching said one side or the other side of said substrate to a first supporting structure; and

forming a multiplicity of trenches in said material on the side of said substrate not attached to said supporting structure, wherein said trenches are located in areas between said sensor elements.

46. The method as recited in claim 45, wherein said first supporting structure is a layer of acoustically attenuative material attached to said other side of said substrate.

47. The method as recited in claim 45, wherein said first supporting structure is a layer of wax having a relatively low melting temperature attached to said one side of said substrate.

48. The method as recited in claim 45, further comprising the following steps:

attaching a second supporting structure to the side opposite the side to which said first supporting structure is attached; and

removing said first supporting structure.

49. The method as recited in claim 48, wherein said first supporting structure is a layer of wax having a relatively low melting temperature attached to said one side of said substrate, and said removing step comprises melting said wax.

50. The method as recited in claim 49, wherein said second supporting structure is a layer of acoustically attenuative material.